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EXAMINER	
LAI, ANDREW	

ART UNIT	PAPER NUMBER
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/776,466	KODIALAM ET AL.	
	Examiner	Art Unit	
	Andrew Lai	2616	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *11 February 2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-16* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-3, 5-9 and 11-16* is/are rejected.

7)☒ Claim(s) *4 and 10* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *11 February 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 112

1. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

2. Claim **16** is rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

> **Claim 16** recites: *A network having capacity of the network allocated into working capacity and restoration capacity, the network comprising:*
> *means for generating a set of network constraints…;*
> *(b) formulating a linear programming problem (LPP)…; and*
> *(c) generating either an exact or an approximate solution ….*

This is a Single Means Claim. "A single means claim, i.e., where a means recitation does not appear in combination with another recited element of means, is subject to an undue breadth rejection under 35 U.S.C. 112, first paragraph. *In re Hyatt,* 708 F.2d 712, 714-715, 218 USPQ 195. 197 (Fed. Cir. 1983) (A single means claim which covered every conceivable means for achieving the stated purpose was held nonenabling for the scope of the claim because the specification disclosed at most only those means known to the inventor" (MPEP 2164.08(a)). Examiner interprets Claim 16 as being read:

> *A network having capacity of the network allocated into working capacity and restoration capacity, the network comprising:*
> *(a) means for generating a set of network constraints…;*
> *(b) means for formulating a linear programming problem (LPP)…; and*
> *(c) means for generating either an exact or an approximate solution ….*

And subsequent Office action will be based on this reading of the claim.

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. Claims 4, 8, **12**, 13 and 14 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 4 recites "... *where ... and m(e) is the maximum flow value between nodes couled by e when e is removed from the network*". There is insufficient antecedent basis for *m(e)* either in claim 4 itself or claim 1 whereinupon claim 4 depends. However, in light of the specification, it appears that said *m(e)* should instead be the $F(e)$ in the formula of claim 4 and thereon subsequent Office action will based.

Claim 8 recites "... *where i and j are indices corresponding to node numbers, ... P_e denotes the set of all paths P from node i to node j that do not contain link (i, j) = e ...*". There is insufficient antecedent basis for *indices i* and *j* either in claim 10 or any of its parent claims. The claim 8 language is unclear and indistinct to such an extent that it is impossible to search for prior art. However, an absence of prior art should not be construed as indicating allowable subject matter.

Claim 12, recites the limitation of "... *(a) determining a link $\bar{e}$ and a corresponding shortest path P for which a combination of i) a sum ... and ii) a sum ... is a* ***relative minimum*** *... (e) repeating steps (a) through (e) until a set of* ***dual feasibility constraints*** ".

There appear to have two problems with this claim.

Problem 1: It is unclear what the term ***relative minimum*** therein means. A closest teaching appears to be on page 11 paragraph 3 of the application wherein, after disclosing expressions (12) and (13), stated are "For a given link e, $g(e)$ denotes the minimum value of the left hand side (LHS) of the dual program constraint in equation [should in fact be inequality] (13) over all paths $P \in P_e$". Further, page 12 first paragraph discloses "a feasible solution for the dual program is satisfied if and only if the relation of equation [should in fact be inequality] (14) holds true: $\min g(e) \geq 1$". There does not appear to be a teaching of ***relative minimum***, especially ***relative*** to what variable or parameter. Even taking inequality (14), it is unclear that relation "$\min g(e) \geq 1$" can be construed as necessarily indicating a **relative minimum** because it is unclear whether said inequality is suggesting ***a)*** $\min[g(e)] \geq 1$, or ***b)*** $\min[g(e) \geq 1]$, wherein ***a)*** would be a suggestion of taking **any minimum value** $g(e)$ as long as it is greater than or equal to 1, which Examiner finds hard to be equivalent to being a **relative minimum**; and ***b)*** would be a suggestion of taking the **closest value greater than or equal to 1** among all $g(e)$'s, which in certain sense suggests a **relative minimum**, relative to the value 1. However, neither the specification nor the claim provided a unique distinction between said ***a)*** and ***b)***.

Problem 2: It is also unclear what the term ***dual feasibility constrains*** therein means. A closest teaching appears to be on page 13 paragraph 2 wherein stated is, in reference to fig. 2 of the Application, "If the test of step 202 determines that the **dual network constraints** are satisfied, then the method advances to step 209. At step 202, if the **dual feasibility constraints** are satisfied, the primal capacity constraints on each link are not necessarily satisfied, since the approximation method increments working capacities with original (and not residual) link capacity at each stage." In light of the specification, it appears to the Examiner there exists a set of **dual network constraints** and a set of **dual feasibility constraints**, which further appear to be two **different** sets because if the former is satisfied the process is done, as shown in fig. 2, while if the latter is satisfied, the process will continue. On the other hand, the claim appears to have set forth that the process would be done if **the latter** is satisfied. In addition, Examiner fails to find disclosure, prior to page 13 paragraph 2, that clearly defines and differentiates **dual feasibility constraints** from **dual network constraints**.

To summarize, the following issues should be clarified:

- What precisely the **relative minimum** is;
- What precisely the **dual feasibility constraints** and the **dual network constraints** are; and
- What precisely the **difference** of the dual **network constraints** is from the dual **feasibility constraints** in view of claim 12 **literally** drawn to the **latter** but **function-wise** drawn to the **former** in light of the specification.

As a result of the problems outline hereinabove, claim 12 appears to be unclear and indistinct to such an extent that it is impossible to search for prior art. However, an absence of prior art should not be construed as indicating allowable subject matter.

Claims 13 and 14 are rejected on same ground as claim 12 for their dependencies thereupon.

Claim Rejections - 35 USC § 102

5. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

6. Claims **1,15,16** and 2,3,5,6,11 are rejected under 35 U.S.C. 102(b) as being anticipated by Grover et al (US 202/0071392, Grover hereinafter).

Grover discloses a "design of a meta-mesh of chain sub-networks" (p1 lines 1-2) "that include plural nodes terminating plural spans" ([0023] lines 3-4) comprising the following features.

Regarding claim 1, *a method* (see "a method of restoring a telecommunications method" recited [0023] line 2) *of partitioning ...*

Regarding claim 15, *a computer-readable medium having stored thereon a plurality of instructions, the plurality of instructions including instructions which, when executed by a processor, cause the processor to implement a method* (see "there is provided a method of distributing spare capacity in a telecommunications network ... the

method comprising the steps of characterizing, in a **computer**, the telecommunications network as a network containing nodes..." recited [0026] lines 2-6) *of partitioning ...*

Regarding claim 16, *a network* (figs. 1 and 14) *having ...*

capacity of a network [claims 1 an 15] (see e.g. fig. 1) or *links* [claim 12] or *the network allocated* [claim 16] *into working capacity and restoration capacity* (see "we consider span-restorable networks where the routing of working paths (and hence working capacity) is jointly optimized with spare capacity assignment to minimize total capacity" recited [0016] lines 9-12 wherein "spare capacity" is used as *restoration capacity* as recited [0006] lines 2-5 "achieve 100% restorability against any single span failure either through network protection or restoration using a designed-in allocation of spare capacity"), *the method comprising the steps of* [claims 1, 12 and 15] or *the network comprising* [claim 16]:

Regarding claim 16, *a means* (see means for "the network capacity [be] subject to the constraints" recited [0025] lines 8-9) *for...*

Regarding claims 1, 15 and 16:

(a) generating a set of network constrains (see [0021] for constraints formulas (2), (3), (4), and (5) wherein "**Constraints** (2) ensure that all working demands are routed. **Constraints** (3) generate the required working capacity on each span j to satisfy the sum of all (pre-failure) working demands routed over it. **Constraints** (4) ensure that restoration for failure of span I meets the target level of 100%. **Constraints set** (5) forces sufficient spare capacity on each span such that the sum of the restoration paths routed over that span is met for failure of any span I" recited [0022] line 2 on p3 – [0022]

line 9 on p4) *for a network of nodes interconnected by links in accordance with a network topology* (see fig. 4 which "is a schematic showing 'meta-mesh' topology of the network in fig. 1" recited [0032] lines 1-3);

Regarding claim 16, *a means* (see means of "arc-path Integer Linear Programming (IP) formulation" recited [0020] lines 2-3) *for...*

Regarding claims 1, 15 and 16:

(b) formulating a linear programming problem (LPP) for the network topology based on the set of network constraints (see "The design of span-restorable mesh network is most often approached using an arc-path Interger **Linear Programming (IP) formulation** introduced for SCA [20]. As our benchmark here we will use an extension of the model [20] to include joint optimization of the working path routing" recited [0020] lines 1-6 wherein "model [20]" is given by Herzberg et al as cited in [0112]); *and*

Regarding claim 16, *a means* (see means of "implementing a telecommunications network" recited [0027] lines 1-2 "once planned" recited [0027] line 1) *for...*

Regarding claims 1, 15 and 16:

(c) generating either an exact or an approximate solution for the LPP, the solution including a corresponding [claim 16] *working capacity and a corresponding* [claim 16] *restoration capacity* (see "Once planned, the **resulting** telecommunications network may be implemented" recited [0027] lines 1-2 and further "Once built, the same process can be used for ongoing **decisions** about which equipment elements in the chain to **rout a new demand** [*working* capacity] through and where in the network,

spare capacity [*restoration capacity*] needs to be augmented to ensure **restorability**, if anywhere" recited [0027] lines 7 – 9. See additionally fig. 8, as an example, depicting curves for *working capacity and restoration capacity* in terms of "working channels" with symbol ▲ and "spare channels" with symbol ■, respectively) *of each link of the network* (see [0021] for "JCA [joint capacity assignment]" equation (1) "$\sum_{j\varepsilon S} c_{j/l} L_j (w_j + s_j)$" with w_j denoting "the number of working capacity unites on span j" and s_j "the number of spare [restoration] capacity units placed on span j" as recited in the list immediately above [0021].)

Regarding claim 2, *the invention of claim 1, further comprising the step of d) partitioning the capacity of each link of the network based on the solution for the LPP* (see [0021] for "JCA [joint capacity assignment]" eq. (1) "minimize $\sum_{j\varepsilon S} c_{j/l} L_j (w_j + s_j)$" with w_j denoting "the number of working capacity unites on span j" and s_j "the number of spare [restoration] capacity units placed on span j" as recited in the list immediately above [0021].).

Regarding claim 3, *wherein, for step (a), the network constraints are 1) for each link, a set of detour paths exists* (see "Span restoration is like deploying a set of detours around the specific break" recited [0015] lines 4-5) *whose capacities sum to the working capacity of the link* (see [0021] formula (4) and "Constraints (4) ensure that restoration for failure of span I meets the target level 0f 100%" recited p4 left col. lines 2-3 noting wherein formula (4) w_j denoting "the number of working capacity unites on span j" as recited last lime of the list immediately above [0021] and f_i^P denoting "Restoration flow assigned to p^{th} eligible restoration route for span i" as recited line 12 of the list

immediately above [0021]); *2) for each link, the sum of the working capacity and the restoration capacity shared by the set of detour path is, at most a total capacity of the link* (see [0021] formula (2) and "Constraints (2) ensure that all working demands are routed" recited [0022] lines 2-3 wherein formula (2) d^r denoting "Number of demand units for O-D [origination-destination] pair r" recited line 4 of the list immediately above [0021] and $g^{r,q}$ demoting "Working capacity assigned to the q^{th} eligible working route for demand pair r" recited lines 14-15 of the list immediately above [0021]); *and 3) the working capacity of the network is maximized* (see [0021] formula (3) and "Constraints (3) generate the required working capacity on each span j" recited [0022] lines 3-4 noting again the description for $g^{r,q}$ and w_j in the list immediately above [0021]).

Regarding claim 5, *the invention of claim 1, wherein, for step (b), the LPP is a path-indexed LPP formulation* (see "The resultant designs comprise a special class of restorable network that is intermediate between pure span restoration and **path restoration**. Most of the efficiency of path restoration is achieved" recited Abstract lines 19-22).

Regarding claim 6, *the invention of claim 5, wherein step (c) further comprises the step of (c1) generating a dual of the path-indexed LPP formulation* (see "Constraint set (5) from the JCA formulation is also modified to capture the **dual-failure** scenarios when a chain span is cut causing its bypass span to simultaneously fail" recited [0058] lines 1-3).

Regarding claim 7, *wherein step (c) further comprises the step of (c2) approximating the solution* (see "it is believed that span restoration on the meta-mesh

abstraction of a sparse graph can approximate the restoration on the full graph" recited p11 left col. lines 13-15).

(note: Grover does not disclose a $(1 + \varepsilon)$ approximation formulation, which will be discussed further below)

Regarding claim 11, *the invention of claim 1, wherein, for step (2), the network is either an electro-optical network or a packet-based network* (see "these schemes are fairly easily mapped into DWDM implementations between **opto-electronic** cross connects" recited [0016 lines 16-18).

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

8. Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Grover et al (US 2002/0071392, Grover hereinafter) in view of Hauser et al (Capacity design of Fast Path Restorable Optical Networks, *IEEE INFOCOM 2002, p. 817 – 826*, Hauser hereinafter).

Grover discloses claimed limitations as applied above in paragraph 6 to claim 1. Grover does not disclose the following feature of **claim 7**:

[*... approximating the solution*] *with a (1+ε) approximation algorithm.*

Hauser discloses "fully polynomial approximation schemes that solve the restorable network capacity design problem" (p817 Abstract last three lines) comprising

the following feature of **claim 7** of [*... approximating the solution*] *with a (1+ε) approximation algorithm* (see "We the use a primal dual approach to develop a Fully Polynomial Time Approximation Scheme (FPTAS). The idea in FPTAS is to obtain an ε optimal solution to the problem. An ε optimal solution to the maximizing problem that has a value at least (1- ε) times the optimal solution." recited p820 left col. last paragraph).

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the approximation formulation of Grover by incorporating the particular (1+ε) approach of Hauser into Grover in order to provide a more efficient and practical mechanism leading to "algorithm for network capacity desing that explicitly accounts for fast restoration requirements" as pointed out by Hauser (p817 Abstract lines 10-11).

8. Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Grover et al (US 2002/0071392, Grover hereinafter) in view of Saito (US 6,404,744).

Grover discloses claimed limitations as applied above in paragraph 6 to claim 1. Grover does not disclose the following feature of **claim 9**, *the invention of claim 1, wherein, for step (b), the LPP is a link-indexed LPP formulation.*

Saito discloses "A method for designing a communication network" (Abstract lines 1) wherein "Stochastic constraints are generated by using the requested capacity of a demand to produce a stochastic programming problem" (Abstract lines 2-5, noting that "stochastic programming problem" is a variation of *linear programming program* as well known in the art) comprising the feature of

claim 9, *the invention of claim 1, wherein, for step (b), the LPP is a link-indexed LPP formulation* (see fig. 3 step S306 "transform a stochastic programming problem formed of the objective function and the constraint expressions into an equivalent determinate programming problem" and step S307 "solve the equivalent determinate programming problem and thereby obtain capacities of respective links and nodes").

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the method of Grover by adding the link indexed approach of Saito (note that Grove already implied link oriented solution in his "pan" oriented approach. See e.g. [0008] lines 13-16 "Each working capacity unit of a span is thus part of a logical link in a client service-layer network, all such links being destined to fail together if the corresponding physical span fails.") in order to provide a more robust mechanism for "a communication network design method that is capable of accommodating traffic varying due to variations in demand pattern" as pointed out by Saito (col. 1 lines 12-14).

Allowable Subject Matter

9. Claims 4 and 10 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Claim 4 recites:

> *The invention of claim 1, wherein for step (b), the LPP formulation is generated for the network having an equal partition size for the working capacity and restoration capacity of each link e of a set E of links in the network, and step (c) generates the solution based on a fraction α for the equal partition size the fraction α given by*
>
> $$\alpha = \min_{e \in E} [\, F(e)/(u_e + F(e)) \,]$$
>
> *where "min(•)" denotes the mathematical "minimum of •", u_e is the capacity of link e and $F(e)$ is the maximum flow value between nodes coupled by e when e is removed from the network.*

Claim 10 recites:

The invention of claim 9, wherein for step (b), the link-indexed LPP formulation is given by:

$$max \sum_{(k,l) \in E} x_{kl}$$

$$\sum_{j:(i,j) \in E} y_{ij}^{kl} - \sum_{j:(j,i) \in E} y_{ji}^{kl} = \begin{cases} x_{kl} & if\ i = k \\ -x_{kl} & if\ i = l \\ 0 & otherwise \end{cases}$$

.... (rest of mathematical expressions omitted)

wherein i, j, k, and l are indices corresponding to node numbers, "max(•)" denotes the mathematical "maximize •", N denotes a set of nodes in the network, E denotes a set of links in the network, u_{ij} denotes the capacity of link (i,j), x_{ij} ($0 \leq x_{ij} \leq u_{ij}$) denotes a working capacity reserved on link (i,j), y_{ij}^{kl} denotes a network flow equal to x_{ij} from node k to node l using links other than (k,l).

The closest prior art of Grover (US 2002/0071392) and/or Saito (US 6,404,744), singularly or in combination, fails to anticipate or render above features obvious.

Conclusion

10. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

US 5,854,903 provides a method for network optimization based on multirate, circuit-switched analysis determined as a solution to a set of linear equations.

US 6,086,619 discloses an apparatus and method for modeling optimization problems using linear and quadratic programs.

US 4,744,027 teaches a method and apparatus for optimizing the operational state of a system employing iterative steps approximately following a projective scaling.

US 2002/0167898 discloses restoration of IP networks using precalculated restoration routing tables.

Yijun Xiong et al (IEEE/ACM Transactions on Networking, Vol. 7 No. 1 (Feb. 1999)) studies the capacity and flow assignment problem arising from the design of self-healing ATM network using the virtual path concept.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Andrew Lai whose telephone number is 571-272-9741. The examiner can normally be reached on M-F 7:30-5:00 EST, Off alternative Fridays.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kwang Yao can be reached on 571-272-3182. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

KWANG BIN YAO
SUPERVISORY PATENT EXAMINER

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